Method of Calculating Premium Payment to Cover the Risk Attributable to Insureds Surviving a

Specified Period

1   TITLE

2   The title of this invention is "Method of Calculating Premium Payment to Cover the Risk

3   Attributable to Insureds Surviving a Specified Period" by Kiri Parankirinanthan.

4   CROSS-REFERENCE TO RELATED APPLICATION

5   This application claims the benefit of U.S. Provisional Application entitled "Method of

6   Calculating Premium Payment to Cover the Risk Attributable to Insureds Surviving a Specified

7   Period", Serial Number 60/507,170 filed September 30, 2003 which is incorporated herein by

8   reference.

9   FIELD OF INVENTION

10   The invention relates to the field of financial products and methods involving the provision of

11   death benefits through life insurance. As used in this invention, the expression "life insurance"

12   relates to the type of insurance policy that provides a death benefit if the life or lives insured by

13   the policy die while the insurance policy is in force or effect.

14   BACKGROUND OF THE INVENTION

15   Life insurance companies, through the issuance of life insurance policies, accept a transfer of the

16   risk of adverse financial consequences which would be created when an insured life dies.

17   Typically, the death of an individual creates adverse financial consequences for those who

18   depend on future income or work contributions lost as a result of the individual's death. A life

19   insurance policy is typically purchased to provide a beneficiary with a death benefit payment.

20   The purpose of the death benefit payment is to provide the beneficiary with the means to offset,

1   at least in part, the financial strain created by the unexpected or untimely early death of the

2   insured.

3

4   Life insurance pricing (that is, the determination of the premium charged by the insurance

5   company for the acceptance of a stated death benefit risk) is based on a number of factors for

6   which assumptions are made including: mortality, interest, expenses (including taxes), and policy

7   persistency. Policy persistency is the probability that the owner of a life insurance policy will

8   choose to keep the policy in force by paying the premiums required as per the terms of the

9   insurance contract. A policyholder who does not persist is said to have lapsed. An assumption

10   with respect to lapse rates is typically the way persistency is incorporated into pricing

11   calculations. Pricing assumptions are made prior to the issuance of a life insurance policy and are

12   made relative to an entire class of insured lives and not with respect to individual insureds.

13

14   A number of different sets of pricing assumptions may be used. Assumption sets may vary by

15   mortality class, type of distribution used, or by other characteristics commonly used to

16   distinguish between classes of insured lives in the insurance industry. For example, different

17   mortality assumptions may be applied to males versus females or to non-smokers versus

18   smokers. Those skilled in the art are well aware of the fact that many other mortality class

19   distinctions exist or are possible.

20

21   Also, different expense assumptions may be applied in different marketing situations. For

22   example, insurance offered directly to the consumer in a direct marketing distribution channel

1   versus insurance offered through a traditional agent based distribution channel will have different

2   expense assumptions applied to reflect the different expected costs in these different marketing

3   channels.

4

5   The interest rate assumptions used in pricing are important because they provide an adjustment

6   for the timing differences between when cash goes into and out of the pricing calculations.

7   Persistency or lapse assumptions affect pricing calculations by creating an expectation with

8   respect to the occurrence of cash flows which are dependent on the insurance policy being in

9   force or effect.

10

11   When an individual insured applies for life insurance, an underwriting process is applied. The

12   underwriting process determines, the appropriate premium or underwriting class for the applicant

13   based on an evaluation of the applicant's mortality characteristics and life expectancy. This is

14   based in part on expertise the underwriter derived from prior training or experience. Life

15   expectancy is the average number of years individuals in the same underwriting class can be

16   expected to live. Maximum life expectancy is the highest age to which an individual in the

17   underwriting class can be expected to live.

18

19   A life insurance policy may provide for some change in assumptions after the policy is issued.

20   Such changes would modify the current charges or credits provided for in the policy for a class

21   of insureds. These changes would result in a change in the overall cost of the life insurance for

22   each insured in the same class of insureds. Such changes can only be justified by changes in

1   experience after issue for the whole class to which an insured belongs and can only be applied to

2   all insurance policies in the class. Typically the range of change allowed in a life insurance

3   policy is limited by minimum or maximum guarantees made in the life insurance contract or

4   policy relative to each assumption that may be changed.

5

6   One type of life insurance policy contains an endowment feature. This type of life insurance

7   policy is called an endowment policy.   With respect to such life insurance, the insurance

8   company would pay an amount called the endowment benefit to the insured on the endowment

9   date, for example age 65, if the insured survived to that date. Because of changes in the way life

10 insurance is taxed by the US federal government, endowment policies of this sort are, typically,

11 no longer offered as there are adverse tax consequences associated with life insurance policies

12 that endow prior to age 95.

13

14 The assumptions used in pricing a life insurance policy include an assumption regarding the

15 maximum life expectancy of the lives insured. For many currently issued life insurance policies,

16 this maximum life expectancy has been assumed to be age 100. More recent mortality tables

17 used for life insurance pricing purposes are beginning to recognize longer maximum life

18 expectancies, for example, age 120. These longer maximum life expectancies are made possible

19 by improvements in health care and a general improvement in the health of the insured life

20 population. Mortality tables developed for purposes other than life insurance pricing may have

21 found it convenient to make assumptions regarding the maximum life expectancy different from

1   age 100. For example, annuity products may use mortality tables for pricing purposes with a

2   maximum life expectancy greater than age 100.

3

4   This maximum life expectancy age is often referred to as the maturity age for the life insurance

5   policy. Any insured who survives to the end of this period can be thought of as reaching the

6   ultimate endowment age. Typically, life insurance companies will make the death benefit of the

7   life insurance policy available in some way to insureds who survive to the maturity age. One

8   alternative is to pay an amount equal to the death benefit at the maturity age directly to the

9   insured as an endowment benefit on the maturity date. Another alternative is for the insurance

10 company to hold such a maturity age endowment benefit in an interest bearing account until such

11 time as the insured actually dies. Then the benefit is paid as a death benefit. This later

12 alternative is used to potentially avoid the possible adverse tax consequences associated with

13 paying the death benefit to the insured before the insured actually died.

14

15 In the past, the value in a life insurance policy was determined only by the contractual terms of

16 the life insurance policy and confined to the relationship the owner of the policy had with the

17 insurance company providing it. Recently, however, secondary markets for life insurance

18 policies have developed in which a life insurance policy is purchased or the right to receive the

19 death benefit is assigned to a third party by the owner of the policy in exchange for a fee or

20 purchase price.

21

1   Examples of the operation of secondary markets can be seen in the life settlement market and

2   viaticals. These markets involve life insurance policies on insured lives who become impaired

3   after their policies were originally issued. In these markets, life insurance policies are purchased

4   by third parties (that is, neither the owner of the policy nor the insurance company issuing the

5   policy) or assigned to third parties for a fee or payment of some sort. For such payment the

6   third party receives the right to receive the policy death benefit when the insured dies.

7

8   An impaired life is an insured life who develops an impairment after the life insurance policy

9   was originally issued which reduces his or her life expectancy. An impairment is any medical

10 condition affecting the health status of the insured life which results in a higher mortality rate for

11 the insured life than was reflected in the original mortality assumption made for the underwriting

12 class the insured was assigned to when the insurance policy was issued. Because of the

13 impairment acquired after original issuance of the policy, the likelihood of an earlier than

14 expected death claim is increased. This situation may make life insurance policies covering

15 such impaired lives worth more than the cash surrender value provided by the contractual terms

16 of the policies.

17

18 The cash surrender value of a life insurance policy is the amount of money the life insurance

19 company that issued the policy is willing to pay if the policy is lapsed or surrendered. A life

20 insurance policy is lapsed if the owner of the policy stops paying the premiums required to keep

21 the policy in force per the terms of the life insurance contract. For a typical term life insurance

22 policy or whole life insurance policy, the policy lapses when the owner stops paying the

1   contractually required premiums. A whole life insurance policy may have a cash value at the

2   time it lapses which can be surrendered and paid to the policy owner in cash or applied by the

3   policy owner under one of the nonforfeiture options contained in the policy contract.

4

5   For a universal life or variable universal life insurance policy with a flexible premium structure,

6   the policy lapses when the cash value of the policy becomes insufficient to cover the insurance

7   related charges specified in the policy contract. Typically this occurs because the policy owner

8   has not made premium payments prior to the lapse sufficient to keep the policy cash value large

9   enough to cover said charges.

10

11 A life insurance policy can be surrendered by an owner who voluntarily agrees to terminate the

12 life insurance protection provided by the policy in exchange for the payment of the policy's cash

13 surrender value. A life insurance policy's cash surrender value is the cash value of the policy

14 defined in the life insurance contract adjusted for any amounts owed by the owner to the

15 insurance company (for example, policy loans) or any additional amounts owed by the insurance

16 company to the owner (for example, dividends). For universal and variable universal life

17 insurance forms of insurance there may also be specifically stated surrender charges which are

18 deducted to determine the cash surrender value.

19

20 Life insurance benefits may also be assigned to third parties in insurance marketing programs in

21 which life insurance is used as a funding mechanism by a benefit plan sponsor. The benefit plan

22 sponsor is a third party which pays for or in some other fashion enables benefits related to the

Method of Calculating Premium Payment to Cover the Risk Attributable to Insureds Surviving a Specified Period

1   life or health of an individual or individuals. The benefits provided by the benefit plan sponsor

2   consist of cash payments designed to fund health, retirement, or death needs. Funding

3   mechanisms which utilize life insurance benefits rely either on the cash values built up within a

4   set of life insurance policies or the life insurance policies' death benefits to meet funding

5   requirements for a benefit plan.

6

7   Several benefit plans have been funded with the expectation of full or partial funding cost

8   recovery via anticipated or expected death benefit proceeds from the life insurance policies.

9   When death benefit proceeds are used to reduce or recover the cost attributable to benefit plans,

10   it is important that the death proceeds be received in a predictable manner based on a set of

11   mortality assumptions chosen by the benefit plan sponsor. Such chosen mortality assumptions,

12   however, are often inaccurate due to the fact that the actual mortality experience for a selected

13   group is difficult to determine because, generally, such data is not publicized by the insurance

14   companies or reinsurance companies that collect the data.

15

16   Many benefit plans involving the use of life insurance policies as a funding vehicle do not take

17   into account changes in the health status of the insured lives after the insurance policies were

18   issued. That is, they do not rely for their value on the insured life becoming impaired. In order

19   for life insurance policies to be an effective funding tool in programs in which death proceeds are

20   the funding source, however, the death benefits actually received must be reasonably close to the

21   death benefits expected based on the mortality assumptions used to set up the program.

22

Method of Calculating Premium Payment to Cover the Risk Attributable to Insureds Surviving a Specified Period

1   It is well recognized that for the financial products created by the use of life insurance death

2   proceeds as a funding vehicle, adverse financial consequences are created if the actual mortality

3   experience of the lives insured under the life insurance policies being used is better than

4   assumed. That is, adverse financial consequences are created for the third parties if the insured

5   lives, as a group, live longer than expected. This can occur, for example, if a financial product is

6   created by the purchase of a pool of life insurance policies insuring a group of insureds who have

7   lives that are impaired at the time of purchase but who ultimately as a group live longer than

8   expected. The investors providing the cash used to make these purchases are expecting a return

9   on the money they have invested. The return the investors receive is derived from the death

10   benefits that are paid on the life insurance policies that were purchased with the cash they

11   provided. This return is expected to consist of the return of their invested principal plus an

12   investment return. The amount of the investment return or income the investors receive is

13   dependent on the amount and timing of the actual death benefit proceeds received from the group

14   of policies purchased. A purchase price value is calculated for the policies being purchased

15   which is based on mortality assumptions from which the timing and amount of expected future

16   death proceeds can be projected. In addition, other expense and risk charge assumptions are

17   typically made in order to determine a final purchase price for such life insurance policies.

18

19   Since it is the death proceeds of the group of policies purchased which provide the revenue to

20   pay back the investors their principal and a return on their investment, the actual death proceeds

21   must be reasonably close to the expected death proceeds in amount and timing for the expected

22   investment return to be realized. In a life settlement transaction, the investors would experience

1   adverse financial consequences if the insured lives experienced better mortality as a group than

2   the mortality assumption used to determine the purchase price for the policies.

3

4   Another example of when a set of insureds living longer than expected would have adverse

5   financial consequences for a third party beneficiary, would be a situation in which a benefit

6   plan's funding was dependent on the actual death proceeds from a life insurance policy or group

7   of life insurance policies for which the insured or insureds health was not impaired. The benefit

8   plan sponsor anticipates receiving life insurance policy benefits in an expected manner with

9   respect to timing and amount. Such expectation would be based on the assumed level of

10   mortality used in establishing the benefit plan's funding. Death benefit proceeds received by the

11   plan sponsor later than expected, in lower amounts, or not at all would result in adverse financial

12   consequences to the benefit plan sponsor since this would result in the benefit plan being under

13   funded.

14

15   The financial risk that a third party beneficiary faces from a set of insured lives living longer

16   than expected is referred to herein as a "survival risk". There is a need for a method of insuring

17   against the adverse financial consequences of survival risk.

18

19   Given the variety of benefit programs in the insurance industry which are based on the inherent

20   tax advantages attributable to the payment of death benefit proceeds and rely on the timely

21   payment of death benefit proceeds according to projections based on reasonable mortality

22   assumptions, it would be desirable to have an insurance product under which the risk of survival

1   and the adverse financial consequences of survival longer than expected could be transferred

2   from one entity to another entity willing to accept that survival risk for a premium.

3

4   SUMMARY OF THE INVENTION

5   The present invention comprises a method for insuring against the adverse financial

6   consequences of survival risk to a third party and a means for calculating the premium for said

7   insurance. Said insurance is referred to herein as "survival risk insurance". Said third party is

8   referred to herein as the Coverage Recipient. The party providing survival risk insurance is

9   referred to herein as the Coverage Provider.

10

11   The method for a Coverage Provider providing survival risk insurance to a Coverage Recipient

12   comprises the steps of:

13   • selecting a group of insured lives such that the insured lives belong to a mortality

14   class as of a beginning date;

15   • calculating an expected death benefit payable to the Coverage Recipient due to

16   expected deaths of the members of the group of insured lives, said deaths

17   occurring between the beginning date and an end date;

18   • committing the Coverage Provider to pay the Coverage Recipient a benefit equal

19   to a percentage of the positive difference between the expected death benefit and

20   an actual death benefit payable to the Coverage Recipient due to actual deaths of

21   members of the group of insured lives, said deaths occurring between the

22   beginning date and the end date;

1   •   committing the Coverage Recipient to pay a premium to the Coverage Provider in

2   exchange for the benefit.

3   DETAILED DESCRIPTION OF THE INVENTION

4   Specific embodiments of the present invention are described below. These examples are not

5   meant to be limiting.

6

7   Survival risk insurance may comprise a Coverage Provider offering to pay to a Coverage

8   Recipient an amount equal to a percentage of the death benefit of an original life insurance

9   policy issued to an insured by an original life insurance company at the end date of a specified

10   period of time if the death of the insured does not occur during the specified period of time. The

11   Coverage Provider would receive the death benefit proceeds at a later time when the death of the

12   insured actually occurs or the original life insurance policy endows. The original life insurance

13   policy must be kept in force by fulfilling the contractual obligation of the policy owner to the

14   original life insurance company.

15

16   Survival risk insurance would be evidenced by a survival risk insurance policy issued by the

17   Coverage Provider to the Coverage Recipient. The specified period would begin on the date the

18   survival risk insurance policy was issued. This date is the beginning date.

19

20   The survival risk insurance policy premium payable by the Coverage Recipient to the Coverage

21   Provider would be calculated using a method of premium calculation. The method may be

1   expressed in a formula. The results of the formula may be calculated using a computer. More

2   particularly, the results of multiple copies of the formula may be calculated using a spreadsheet.

3

4   The formula to calculate the survival risk insurance policy premium is a function of:

5   • the probability of survival of the insured from the beginning to the end of the specified

6   period;

7   • the probability of the death of the insured for each year or fraction thereof after the

8   specified period;

9   • an interest rate representing the cost of use of money by the Coverage Provider;

10   • a default risk attributable to the original life insurance company;

11   • a default risk attributable to at least some entity maintaining the original life insurance

12   policy in force after the specified period until maturity of the original life insurance

13   policy by death or endowment;

14   • applicable expenses, such as taxes; and

15   • profits.

16

17   Unless otherwise defined herein, all terms and expressions used herein have their standard

18   actuarial meaning as defined in the Society of Actuaries' Textbook on Life Contingencies

19   (Second Edition) by Chester Wallace Jordan Jr. published by the Society of Actuaries in 1967.

20

Method of Calculating Premium Payment to Cover the Risk Attributable to Insureds Surviving a

Specified Period

1   **Description of Assumptions Us d In Calculations Herein**

2   *Probability of death or survival*: The probability of death may be based on standard experience

3   mortality tables, such as the 1990-95 Basic Select and Ultimate Mortality Table developed by the

4   Society of Actuaries, or the mortality tables based on mortality experience and developed in-

5   house by life insurance companies or reinsurance companies. Such mortality tables would be

6   modified with respect to each insured life based on assumptions and methods commonly applied

7   by those skilled in the art to reasonably reflect the survival risk of the lives in a select group of

8   insured lives. These methods involve collecting data applicable to the current health of an

9   insured life (including but not limited to the most recent medical reports available on the health

10   status of the insured life) in order to determine a current mortality rating to be applied to a

11   standard experience mortality table.

12

13   *Interest Rate*: This is a hurdle or interest rate set by the Coverage Provider representing the time

14   value of money relative to the Coverage Provider's needs. The interest rate used by the

15   Coverage Provider will reflect interest rates currently available to the Coverage Provider for

16   other uses of the Coverage Provider's money. The time value of money reflected in an interest

17   rate includes a charge for the risk associated with the return of principal invested or lent.

18   Therefore, the interest rate used by the Coverage Provider will reflect these environmental

19   factors. Typically interest rates can be in the range 4% to 25% for environmental factors within

20   a normal range. Interest rates are annual effective interest rates unless otherwise indicated.

21

22   *Default Risk Attributable to Original Life Insurance Company*: This is a risk associated with

23   the probability that the original life insurance company will ultimately pay the death benefit

1   provided for in the policy it issued to an insured life. The level of this risk depends on the

2   financial stability of the life insurance company, historical trends, and financial strength ratings

3   provided by various insurance industry rating organizations (e.g. A. M. Best, Moody's, Standard

4   & Poors). A typical range for this factor is 0% to 5% of the death benefit.

5

6   *Default Risk Attributable to Coverage Recipient*: This is a risk associated with the probability

7   that the owner of the original life insurance policy on the insured life will meet its contractual

8   obligations to keep the original policy in force beyond the expiry of the specified period. The

9   level of this risk depends on the steps taken by the survival risk insurance policy owner to keep

10   the original life insurance policy in force. As used herein, "owner", means the entity keeping the

11   original life insurance policy in force. The Coverage Recipient would be the owner if they

12   purchased the life insurance policy from the original insured. To minimize the default risk

13   attributable to the Coverage Recipient, for example, the Coverage Recipient may purchase a

14   Guaranteed Investment Contract (GIC) or Annuity that will guarantee the payment of premiums

15   on the original life insurance policy beyond the expiry of the specified period. A typical range

16   for this factor is 0% to 10% of the death benefit.

17

18   *Tax Attributable to death or endowment proceeds*: If a transfer of ownership of the original life

19   insurance policy is utilized between the Coverage Recipient and the Coverage Provider, such

20   transfer of ownership of a life insurance policy may trigger a taxable income to the Coverage

21   Provider when the Coverage Provider ultimately receives the death benefit proceeds of the

22   original life insurance policy. The survival of the insured to the maturity date of the original life

1   insurance policy (attained age 100 for a policy based on the 1980 CSO Valuation Mortality

2   Tables, for example) may trigger an endowment and result in taxable income to the Coverage

3   Provider. The range for this factor is 0 to 1.

4

5   **Means for Calculating Premium**

6

7   A means for calculating the premium for a survival risk insurance policy comprises the following

8   five steps.

9

10   Step I

11   For each life in a selected group of insured lives, determine the present value of a survival risk

12   benefit payable by a Coverage Provider to a Coverage Recipient. The survival risk benefit for

13   each life is equal to a percentage of the life insurance benefit of the insured life. The life

14   insurance benefit is equal to the death benefit or endowment benefit, depending upon whether or

15   not the insured lives to the endowment age specified in the life insurance policy. The survival

16   risk benefit is discounted from the end date to the beginning date using an interest rate and

17   assumed mortality. The discounted survival risk benefit is defined as the present value of the

18   survival risk benefit. The present value of step I is referred to herein as "PV1". It is also

19   referred to herein as "the present value of the Coverage Provider cost".

20

1   Step II

2   For each life in the selected group of insured lives, determine the present value as of the end date

3   of the expected life insurance benefit for each life, assuming the life survives past the end date.

4   The life insurance benefit is discounted to the end date using the probability that the insured with

5   die, or the life insurance policy will endow, on a given date and the interest rate. The present

6   value may be adjusted by tax factors. The present value of step II is referred to herein as PV2.

7

8   Step III

9   For each life in the selected group of insured lives, determine the present value of PV2 as of the

10   beginning date. PV2 is discounted using the interest rate and the expected probability that the

11   life will survive to the end date. The present value of step III is referred to herein as PV3. It is

12   also referred to herein as "the present value of the Coverage Provider reimbursement".

13

14   Step IV

15   For each life in a selected group of insured lives, calculate a single premium for the survival risk

16   insurance policy. The single premium is at least equal to PV1 minus PV3. The single premium

17   may also include factors attributable to the expense and profit of the Coverage Provider, the

18   default risk attributable to the insurance company which issued the original of life insurance

19   policy; and the default risk attributable to the Coverage Recipient, other expenses and profits for

20   the Coverage Provider.

21

1   Alternatively, for each life in a selected group of insured lives, calculate an annual premium for

2   the survival risk insurance policy. The annual premium would be paid over a premium paying

3   period. The annual premium is equal to the single premium divided by a life annuity due factor.

4   The life annuity due factor is the present value of $1.00 payable at the beginning of each year of

5   the premium paying period. It is calculated based on an assumption of the probability of the

6   insured life's survival during the premium paying period. It also is based on an interest rate set

7   by the Coverage Provider. Methods to calculate a life annuity due factor based on mortality and

8   interest assumptions are well known to life insurance actuaries skilled in the art.

9

10   Step V

11   The single premiums or annual premiums for each insured life are summed to give a total single

12   premium or total annual premium for the survival risk insurance policy.

13

14   The following describes formulas used to calculate the premium as per above Steps I – V.

15

16   **Definition of terms used in the formulas:**

17   x = The age of an insured life m at the beginning date. "m" is the number of an insured life in a

18   selected group of insured lives. The term "insured" means "insured life" unless otherwise

19   indicated.

20   q_{x+j} = Probability of death of the insured m between the beginning of year j and the end of year

21   j. j is a number of years after the beginning date.

22   p_{x+j} = Probability of survival of the m from the beginning of year j to the end of year j.

1   i = annual effective interest rate representing the cost of use of money of the Coverage

2   Provider.

3   **PV1** = The amount determined in step I

4   **PV2** = The amount determined in step II

5   **PV3** = The amount determined in step III

6   **DB^m** = The death benefit receivable by a beneficiary on the death of insured m.

7   **F** = The default risk attributable to the insurance company issuing the original life insurance

8   policy on insured m. F is a percentage of the death benefit of insured m.

9   **G** = The default risk attributable to the Coverage Recipient. G is a percentage of the death

10   benefit of insured m.

11   **SPR^m** = Single premium chargeable by the Coverage Provider with respect to a survival risk

12   insurance policy on insured m.

13   **SPR** = Total single premium chargeable by the Coverage Provider for all survival risk insurance

14   policies on insured lives m in the selected group.

15   **s** = The premium paying period for survival risk insurance policy.

16   **APR$_s$^{m}** = Annual premium chargeable by the Coverage Provider for s years with respect to a

17   survival risk insurance policy on insured m.

18   **APR$_s$** = Total annual premium chargeable by the Coverage Provider for s years for all survival

19   risk insurance policies on insured lives m in the selected group.

20   **T1** = An adjustment factor to reflect any tax attributable to death benefit receivable by the

21   Coverage Provider.

1   **T2** = An adjustment factor to reflect tax attributable to any endowment receivable by the

2   Coverage Provider.

3   **N** = Length of the specified period in years.

4    $\ddot{a}_{x:\overline{s}|}$ = a life annuity due of \$1.00 payable at the beginning of each year of a premium paying period.

5   **E** = Expense factor set by the Coverage Provider. E is expressed as a percentage of the death

6   benefit.

7   **H** = Factor for desired profit set by the Coverage Provider. H is expressed as a percentage of the

8   death benefit.

9   **Y** = A percentage applied to the death benefit proceeds.

10   **ω** = the maturity age of the life insurance policy of insured m.

11

12   The following equations define certain parameters.

13    $p_{x+j} = 1 - q_{x+j}$

14    $v = \dfrac{1}{1+i}$

15    $_tp_x = p_x \bullet p_{x+1} \bullet \dots \bullet p_{x+t-1}$

16

1   The following equations are used to calcuate the single premium or annual premium of a survival

2   risk insurance policy.

3

$$PV1 = \frac{Y}{100} \bullet DB^m \bullet {}_N p_x \bullet v^N$$

4

$$PV2 = \{[\sum_{k=N}^{\omega-x-1} v^{k+1-N} \bullet {}_{k-N}p_{x+N} \bullet q_{x+k} \bullet T1 + {}_{\omega-x-N}p_{x+N} \bullet v^{\omega-x-N} \bullet T2] \bullet \frac{i}{\ln(1+i)}\} \bullet DB^m$$

5

$$PV3 = {}_N p_x \bullet v^N \bullet PV2$$

6

$$SPR^m = (PV1 - PV3) + \frac{F+G}{100} \bullet DB^m + \frac{E+H}{100} \bullet \frac{Y}{100} \bullet DB^m$$

7

$$APR_s^m = \frac{SPR^m}{\ddot{a}_{x:\overline{s|}}}$$

8

$$SPR = \sum_{\text{All Policies}} SPR^m$$

9

$$APR_s = \sum_{\text{All Policies}} APR^m$$

10   The factors E, F, G, and H may be set by the Coverage Provider. The factors may have values

11·   commonly used in the life insurance industry or may be calculated using means commonly

12   employed in the life insurance industry.

13

14   **Variations**

15

16   A survival risk insurance policy may be modified in a number of ways. The following describes

17   some of these variations. Other variations may be apparent to one skilled in the art.

18

1   **Variation 1**

2

3   The Coverage Provider may agree to absorb additional risk by agreeing to pay the death benefit

4   of the original life insurance policies at the end of the specified period irrespective to whether

5   deaths occur during the specified period or after the specified period. The Coverage Provider

6   would then collect the death benefits from the original life insurance policies regardless of when

7   the insureds' deaths occur.

8

9   The following formulas would be used to calculate PV1 and PV3.

10   $$PV3 = [\sum_{k=0}^{\omega-x-1} v^{k+1} \bullet {}_k p_x \bullet q_{x+k} \bullet T1 + {}_{\omega-x}p_x \bullet v^{\omega-x} \bullet T2] \bullet \frac{i}{\ln(1+i)} \bullet DB^m$$

11   $$PV1 = v^N \bullet \frac{Y}{100} \bullet DB^m$$

12

13   **Variation 2**

14

15   The Coverage Provider may agree to pay a schedule of periodic payments during the specified

16   period and collect the death benefits from original life insurance policies regardless of when the

17   insured's deaths occur. The Coverage Provider would receive the actual death benefit proceeds

18   for deaths occurring both during and after the specified period. For example, the schedule of

19   periodic payments may be equal to the expected incremental death benefits calculated by using

20   the Coverage Recipient's assumed mortality rates.

21

22   **PV1** would be calculated as the present value of such schedule of payments using standard

23   actuarial methods.

1

2   **Variation 3**

3

4   The Coverage Provider may undertake the responsibility to maintain a positive cash value in the

5   original life insurance policies in order to keep the original policies in force. The survival risk

6   insurance policy premium would be increased to cover such additional cost. The increase will be

7   an amount such that, together with the existing cash value of the original life insurance policy at

8   the time of purchase of the survival risk insurance policy and taking into account the current and

9   guaranteed expense and cost of insurance assumptions of the original life insurance policy, it will

10   be sufficient, if paid as a premium, to keep the original policies in force. All assumptions used

11   will be those considered actuarially appropriate for this purpose by the Coverage Provider. This

12   variation may result in a lower cost being associated with the Default Risk Attributable to

13   Coverage Recipient. Standard actuarial methods would be used to adjust the given formulas.

14

15   **Variation 4**

16

17   The Coverage Provider may undertake to periodically redetermine the mortality rate assumption

18   based on the actual experience of specific populations of insureds covered by survival risk

19   insurance policies. As a result, the Coverage Provider may reserve the right to modify its

20   premium depending on actual experience.

21

1   The Coverage Provider would recalculate the premium based on the redetermined mortality rate

2   assumption. The premium may be increased or decreased.

3

4   **Variation 5**

5

6   The Coverage Provider may offer to pay an amount equal to a percentage of the death benefit of

7   an original life insurance policy as a loan at the end of a specified period if the death of the

8   insured does not occur during the specified period. The Coverage Provider will receive loan

9   interest from the Coverage Recipient in addition to the premium for the survival risk policy. The

10   Coverage Recipient will repay the loan upon receiving the death benefit when the insured life

11   actually dies.

12

13   This variation may allow T1 and T2 to be set equal to 1.0. That is, no tax adjustment would be

14   necessary.

15

16   Alternatively, loan interest may be taken into account in calculating the premium payable to the

17   Coverage Provider by the Coverage Recipient so that the Coverage Recipient does not have to

18   pay loan interest as a separate payment. In such situations PV1 will be increased by an amount

19   called $\textbf{LSPR}^m$. $\textbf{LSPR}^m$ is defined as follows:

20

21     $$\textbf{LSPR}^m = {}_N\textbf{P}_x \bullet \textbf{v}^N \bullet \sum_{t=N}^{\omega-x-1} \textbf{v}^{t+1-N} \bullet {}_{t-N}\textbf{P}_{x+N} \bullet \textbf{q}_{x+t} \bullet \textbf{L}_{t+1-N}$$

22

23   where $\textbf{L}_k$ is the loan interest payable in year k after the end of the specified period.

1

2   L_k may include partially accrued loan interest in the year of the insured life's actual death. This

3   depends on when in the year of death the principal and the accrued loan interest is paid to the

4   Coverage Provider.

5

6   The default risk attributable to the Coverage Recipient may be adjusted to reflect a change in

7   default risk under this variation.

8

9   **Numerical Examples:**

10

11   **Example 1**

12

13   A premium is calculated for a survival risk insurance policy on a single insured life. The insured

14   life under an original life insurance policy is a male nonsmoker who is age 70 at a beginning

15   date. The mortality rate assumed by the Coverage Provider for the insured life is 900% of the

16   1990-95 Basic Select and Ultimate Mortality Table developed by the Society of Actuaries.

17

18   ω equals age 100. T1 is set equal to 0.80. T2 is set equal to 0.65. F is set equal to 1%. G is set

19   equal to 2%. E is set equal to 1%. H is set equal to 2%. The interest rate is set equal to 8%.

20   The percentage Y is set equal to 100%. DB^m equals $1,000,000. The specified period is 10

21   years. Annual premiums for the survival risk insurance policy are to be paid for 3 years.

22

Method of Calculating Premium Payment to Cover the Risk Attributable to Insureds Surviving a

Specified Period

1   Step I: Calculate the value of PV1 defined by the formula:

2   $$PV1 = \frac{Y}{100} \bullet DB^m \bullet {}_{10}P_{70} \bullet v^{10}$$

3   Using standard actuarial methods given the mortality and interest rate assumptions, ${}_{10}P_{70} =$

4   0.11827 and $v^{10} = .46319$ (when i=8%). Therefore, the value of **PV1** = $1,000,000 * .11827 *

5   .46319 = $54,781.48.

6

7   Step II: Calculate the value of PV2 defined by the formula:

8   $$PV2 = \{[\sum_{k=10}^{100-x-1} v^{k+1-10} \bullet {}_{k-10}P_{80} \bullet q_{70+k} \bullet T1 + {}_{20}P_{80} \bullet v^{20} \bullet T2] \bullet \frac{i}{\ln(1+i)}\} \bullet DB^m$$

9

10   The following table shows the individual factors in the summation expression in the formula

11   above and the total for the summation. In calculating the individual terms in the summation, T1

12   is equal to .80 per the previously stated assumptions. $v = 1/(1.08) = .92593$ was used to

13   calculate the v^{t+1} term.

14

TABLE 1

Attained Age	k	t	1990-95 Basic S&U Mortality Rates	q_{80+t} (= 9 times 1990-95 Mortality Rate)	$_tP_{80}$	$_tP_{80}{}^*q_{70+k}$	v^{t+1} $*_tP_{80}{}^*q_{70+k}{}^*$ T1	Sum of Previous Column
80	10	0	0.04008	0.36072	1.00000	0.36072	0.26720	
81	11	1	0.05076	0.45684	0.63928	0.29205	0.20031	
82	12	2	0.06112	0.55008	0.34723	0.19100	0.12130	
83	13	3	0.07906	0.71154	0.15623	0.11116	0.06537	
84	14	4	0.09117	0.82053	0.04506	0.03697	0.02013	
85	15	5	0.10214	0.91926	0.00809	0.00744	0.00375	
86	16	6	0.11477	1.00000	0.00065	0.00065	0.00030	
87	17	7	N/A	N/A	0	0	0	
88	18	8	N/A	N/A	0	0	0	
89	19	9	N/A	N/A	0	0	0	

Method of Calculating Premium Payment to Cover the Risk Attributable to Insureds Surviving a Specified Period

TABLE 1

Attained Age	k	t	1990-95 Basic S&U Mortality Rates	q_{80+t} (= 9 times 1990-95 Mortality Rate)	$_tp_{80}$	$_tp_{80}{}^*q_{70+k}$	$v^{t+1}\,{}^*_tp_{80}{}^*q_{70+k}{}^*$ T1	Sum of Previous Column
90	20	10	N/A	N/A	0	0	0	
91	21	11	N/A	N/A	0	0	0	
92	22	12	N/A	N/A	0	0	0	
93	23	13	N/A	N/A	0	0	0	
94	24	14	N/A	N/A	0	0	0	
95	25	15	N/A	N/A	0	0	0	
96	26	16	N/A	N/A	0	0	0	
97	27	17	N/A	N/A	0	0	0	
98	28	18	N/A	N/A	0	0	0	
99	29	16	N/A	N/A	0	0	0	
100	30	20	N/A	N/A	0	0	0	0.67836

1

2   For i = 8% the value of the expression i/ln(1+i) is 1.039487. Since $_{20}p_{80}$ = 0, the T2 expression

3   in the formula is equal to 0.

4   Therefore, the value of **PV2** = (0.67836 + 0) * 1.039487 *$1,000,000 = $705,146.40.

5

6   Step III: Calculate the value of PV3 defined by the formula:

7   $\mathbf{PV3} = {}_{10}\mathbf{p}_{70} \bullet \mathbf{v}^{10} \bullet \mathbf{PV2}$

8   Using previously given values, **PV3** = .11827 * 0.46319 * $705.146.40 = $38,628.96.

9

10   Step IV: Calculate the single premium, **SPR^m**, for the survival risk insurance associated with

11   this insured life's life insurance policy, m, using the formula:

12   $$\mathbf{SPR}^m = (\mathbf{PV1} - \mathbf{PV3}) + \frac{\mathbf{F+G}}{\mathbf{100}} \bullet \mathbf{DB}^m + \frac{\mathbf{E+H}}{\mathbf{100}} \bullet \frac{\mathbf{Y}}{\mathbf{100}} \bullet \mathbf{DB}^m$$

13   and the annual premium payable for three years, **APR$_3{}^m$**, for the survival risk insurance

14   associated with this insured life using the formula:

$$\mathbf{APR}_3^m = \frac{\mathbf{SPR}^m}{\ddot{\mathbf{a}}_{70:\overline{3|}}}$$

1

2   Substituting the given assumptions and the previously calculated values, $\textbf{SPR}^m = (\$54,781.48 -$

3    $\$38,628.96) + 30,000 + 30,000 = \$76,152.52$. This is approximately, 7.6% of the death benefit.

4   Then, given that $\ddot{a}_{70:\overline{3|}} = 2.61950$

5    $\textbf{APR}_3{}^m = \$29,071.40$. This can be expressed approximately as 2.9% of the death benefit.

6

7   Step V: Calculate the total premium for the survival risk insurance policy by summing the

8   individual policy calculations using the formulas:

9    $$\textbf{SPR} = \sum_{\text{All Policies}} \textbf{SPR}^m$$

10   $$\textbf{APR}_s = \sum_{\text{All Policies}} \textbf{APR}^m$$

11   If there were 10 identical individual life insurance policies in the selected group of policies then

12   $\textbf{SPR} = \$761,525$ and $\textbf{APR}_3 = \$290,714$, rounded to whole dollars.

13

14   **Example 2**

15

16   Calculate the premium for Variation 1 using the data from Example 1, unless otherwise

17   indicated.

18

19   Variation 1, as described above, involves the Coverage Provider agreeing to pay the death

20   benefits for the life insurance policies in the selected group of policies at the end of the specified

21   period and receive all death proceeds irrespective of whether the deaths occur during or after the

1   specified period. This involves using the following formulas in place of the formulas previously

2   given to calculate **PV1** and **PV3** (the term **PV2** is not required for this variation):

3   $$\mathbf{PV1} = \mathbf{v}^{10} \bullet \frac{\mathbf{Y}}{\mathbf{100}} \bullet \mathbf{DB}^m$$

4   $$\mathbf{PV3} = \{[\sum_{k=0}^{100-70-1} \mathbf{v}^{k+1} \bullet_k \mathbf{P}_{70} \bullet \mathbf{q}_{70+k} \bullet \mathbf{T1} +_{100-70} \mathbf{P}_{70} \bullet \mathbf{v}^{100-70} \bullet \mathbf{T2}] \bullet \frac{i}{\ln(1+i)}\} \bullet \mathbf{DB}^m$$

5

6   **PV1** can be calculated to be equal to: $463,193.49.

7

8   The following table shows the individual factors in the **PV3** formula summation expression and

9   the total for the summation.

10

TABLE 2

Attained Age	k	t	1990-95 Basic S&U Mortality Rates	q_{70+t} (= 9 times 1990-95 Mortality Rate)	$_tp_{70}$	$_tp_{70}{}^*q_{70+t}$	$v^{t+1}\,{}^*{}_tp_{70}{}^*q_{70+t}{}^*$ T1	Sum of Previous Column
70	0	0	0.00594	0.05346	1.00000	0.05346	0.03960	
71	1	1	0.00937	0.08433	0.94654	0.07982	0.05475	
72	2	2	0.01285	0.11565	0.86672	0.10024	0.06366	
73	3	3	0.01628	0.14652	0.76648	0.11230	0.06604	
74	4	4	0.01918	0.17262	0.65418	0.11292	0.06148	
75	5	5	0.02217	0.19953	0.54125	0.10800	0.05444	
76	6	6	0.02571	0.23139	0.43326	0.10025	0.04680	
77	7	7	0.02944	0.26496	0.33301	0.08823	0.03814	
78	8	8	0.03230	0.29070	0.24477	0.07116	0.02848	
79	9	9	0.03542	0.31878	0.17362	0.05535	0.02051	
80	10	10	0.04008	0.36072	0.11827	0.04266	0.01464	
81	11	11	0.05076	0.45684	0.07561	0.03454	0.01097	
82	12	12	0.06112	0.55008	0.04107	0.02259	0.00665	
83	13	13	0.07906	0.71154	0.01848	0.01315	0.00358	
84	14	14	0.09117	0.82053	0.00533	0.00437	0.00110	
85	15	15	0.10214	0.91926	0.00096	0.00088	0.00021	
86	16	16	0.11477	1.00000	0.00008	0	0.00002	

TABLE 2

Attained Age	k	t	1990-95 Basic S&U Mortality Rates	q_{70+t} (= 9 times 1990-95 Mortality Rate)	$_tp_{70}$	$_tp_{70}*q_{70+t}$	$v^{t+1}*_tp_{70}*q_{70+t}*T1$	Sum of Previous Column
87	17	17	N/A	N/A	0	0	0	0.51107

2   As previously, for i = 8% the value of the expression i/ln(1+i) is 1.039487. And, since $_{30}p_{70} = 0$,

3   the T2 expression in the formula is equal to 0.

5   Therefore, the value of **PV3** = (0.51107 + 0) * 1.039487 * $1,000,000 = $531,250.62.

6   Therefore, **SPR^m** = – $8,057.13. A negative value for **SPR^M** means the death benefits the

7   Coverage Provider would receive under this variation are worth more than the benefit that would

8   be provided by a survival risk insurance policy. Therefore, a Coverage Recipient would

9   conclude that this is an inappropriate variation to apply

11   **Example 3**

13   Calculate the premium for Variation 2 using the data from Example 1, unless otherwise

14   indicated.

16   Variation 2, as described above, assumes a schedule of payments equal to $100,000 will be paid

17   by Coverage Provider to the Coverage Recipient at the end of each year of the specified period.

18   Using standard actuarial methods to determine the value of this schedule of benefits under

19   interest only discounting yields a value for PV1 = $671,008.14. Thus under variation 2,

1   substituting this value of PV1 for the originally calculated value and using the value for PV3

2   calculated under variation 1, $\mathbf{SPR}^m = \$199,757.52$ and $\mathbf{APR_3}^m = \$76,257.88$.

3

4   **Example 4**

5

6   Calculate the premium for Variation 3 using the data from Example 1, unless otherwise

7   indicated.

8

9   Variation 3, as described above, assumes that the Coverage Provider would allocate $40,000 to

10   fulfill the premium payment obligation to maintain the original life insurance policy in force.

11   This $40,000 allocation would increase the value of PV1 by $40,000 but the Coverage Recipient

12   default risk would be reduced to zero and the term G, therefore, which had been 2% would be set

13   equal to 0.   Therefore, the value of $\mathbf{SPR}^m$ would change from the original calculation by a total

14   of $40,000 - 20,000$ or $20,000$ and, under variation 3, $\mathbf{SPR} = \$96,153.61$ and $\mathbf{APR_3} =$

15   $36,706.86.

16

17   **Example 5**

18

19   Calculate the premium for Variation 4 using the data from Example 1, unless otherwise

20   indicated.

21

1   Variation 4, as described above, allows the Coverage Provider to periodically redetermine the

2   mortality rate it uses to calculate the survival risk cost based on its actual experience. We can

3   assume that the Coverage Provider determines at the end of the first year of coverage provided

4   under the survival risk insurance policy that actual experience is better than originally assumed.

5   The Coverage Provider determines, for example, that mortality is only 80% of the originally

6   assumed mortality at the time of execution of the agreement between Coverage Provider and

7   Coverage Recipient. Recalculating based on this reduced mortality assumption produces a

8   higher value for SPR^m and APR_3^m. Therefore, the Coverage Provider would charge an

9   additional premium.

10

11 The following table provides values necessary to recompute the Coverage Provider charge.

TABLE 3

Attained Age	k	t	1990-95 Basic S&U Mortality Rates	q_{80+t} (= .8 X 9 times 1990-95 Mortality Rate)	$_tp_{80}$	$_tp_{80}{}^*q_{70+k}$	$v^{t+1}\,{}^*{}_tp_{80}{}^*q_{70+k}{}^*$ T1	Sum of Previous Column
80	10	0	0.04008	0.28858	1.00000	0.28858	0.21376	
81	11	1	0.05076	0.36547	0.71142	0.26000	0.17833	
82	12	2	0.06112	0.44006	0.45142	0.19865	0.12616	
83	13	3	0.07906	0.56923	0.25277	0.14388	0.08461	
84	14	4	0.09117	0.65642	0.10888	0.07147	0.03891	
85	15	5	0.10214	0.73541	0.03741	0.02751	0.01387	
86	16	6	0.11477	0.82634	0.00990	0.00818	0.00382	
87	17	7	0.12707	0.91490	0.00172	0.00157	0.00068	
88	18	8	0.13936	1.00000	0.00000	0.00015	0.00006	
89	19	9	N/A	N/A	N/A	N/A	N/A	0.66020

12

13 $_{10}p_{70}$ =0.19017 under these revised mortality assumptions and v^{10} = .46319 (when i=8%).

14 Therefore, the revised value of PV1 = 0.19017*0.46319* $1,000,000= $88,084.84.

1   The revised value of **PV2** = (0.66020 + 0) * 1.039487 * $1,000,000 = $686,269.32

2   Using previously given values, the revised value of **PV3** = .19017 * 0.46319 * $686,269.32=

3    $60,449.92.

4   Given that under the revised mortality assumption $\ddot{a}_{70:\overline{3|}}$ = 2.65163

5   **SPR**^{m} = $87,634.92, **APR$_3$**^{m} =$33,049.45

6   Therefore, the additional single premium that should have been charged at issue = $87,634.92 -

7    $76,153.61 = $11,481.31. The additional annual premium that should have been charged

8   beginning at issue =$33,049.45 - $30,811.46 = $2,237.99

9   The Coverage Provider may charge an additional premium based on standard actuarial practice

10   including the time value and money.

11

12   **Example 6**

13

14   Calculate the premium for Variation 5 using the data from Example 1, unless otherwise

15   indicated.

16   Variation 5, as described above, assumes that an annual loan interest rate equal to 5.00% will be

17   charged by the Coverage Provider. Under this variation, T1 and T2 are set equal to 1 since there

18   is assumed to be no tax consequences associated with the death benefit amount being paid as a

19   loan at the end of the specified period. The values of **SPR**^{m} and **APR$_3$**^{m} would be recalculated

20   with the new values for T1 and T2. Therefore under this variation 5, **PV2** = $881,433.00 and

21   **PV3** = $48,286.21. This produces the following values: **SPR**^{m} = $66,496.36 and **APR$_3$**^{m} =

1 $25,385.13. Given a loan interest of 5%, then 5% of the $1,000,000 death benefit loaned, or

2 $50,000 would be paid by the coverage Recipient to the Coverage Provider each year.

3

4 Alternatively, the anticipated loan interest could be included in the calculation of the survival

5 risk insurance premium by including the term:

6 $$LSPR^m =_{10}P_{70} \bullet v^{10} \bullet \sum_{t=10}^{100-70-1} v^{t+1-10} \bullet_{t-10}P_{70+10} \bullet q_{70+t} \bullet L_{t+1-10}$$

7 in the **PV1** formula as noted in the description of variation 5.

8

9 The following table shows the steps in the calculation of **LSPR^m**:

TABLE 4

Attained Age	k	t	Accumulated Loan Balance at End of Year	L_k Loan interest due at End of Year	$_tp_{80}{}^*q_{70+t}$	Value of LSPR^m term for value of k	Summation of LSPR^m
80	1	10	1,050,000	50,000	0.36072	16,700.00	
81	2	11	1,102,500	102,500	0.29205	25,664.54	
82	3	12	1,157,625	157,625	0.19101	23,900.66	
83	4	13	1,215,506	215,506	0.11116	17,608.12	
84	5	14	1,276,282	276,282	0.03698	6,953.46	
85	6	15	1,340,096	340,096	0.00744	1,594.53	
86	7	16	1,407,100	407,100	0.00065	154.40	
87	8	17			0.00000	0.0	92,576.71

10

11 Then, since $_{10}p_{70} * v^{10}$ = .11827 * .46319 = .05478,

12 **LSPR^m** = .05478 * 92,576.71 = $5,071.35.

13 **PV1**= 54,781.38 + 5,071.35 = $59,852.73

14 As in the first option for variation 5 above, the recalculated value for **PV2** = $881,433.00 using

15 T1=1.0 and T2=1.0.

1   Therefore, **PV3** = $48,286.21 as above and **SPR**^{m} = $71,566.52.

2

3   **Applications:**

4

5   There are a number of applications of how a survival risk insurance product could be used in

6   sales or marketing situations. These are shown for illustration and not meant to be limiting.

7

8   **Application 1: Loan Maturity With Respect To Premium Financing**

9

10   A life insurance policy owner may borrow from a lender to pay premiums to fulfill the

11   contractual premium payment obligations with the life insurance company that issued the life

12   insurance policy. The lender will receive the repayment of the loan plus loan interest at the time

13   of the insured's death. The loan agreement will be structured so that the death benefit proceeds

14   will be large enough to pay to the lender the outstanding loan balance including the accrued loan

15   interest at the time of the insured's death with any remaining death benefit proceeds being paid

16   as a lump sum to the insured's designated beneficiary.

17

18   The cash value of the life insurance policy given the payment of the above noted premium is

19   expected, based on reasonable assumptions, to grow, after all applicable deductions, sufficiently

20   enough to support the policy until death or maturity. However, the sufficiency of the life

21   insurance policy cash value to keep the policy in force until death or maturity and provide a

22   death benefit large enough to repay the loan balance plus accrued loan interest is not guaranteed.

Method of Calculating Premium Payment to Cover the Risk Attributable to Insureds Surviving a Specified Period

1   In addition, in the event that death does not occur during the maturity period of loan, the lender

2   would have to refinance the loan. Lenders would prefer to be more secured with respect to

3   recovering their loan plus accrued loan interest. Loans are generally associated with a fixed

4   maturity period not a maturity period that is determined by a contingent event such as the death

5   of an insured life.

6

7   The present invention will enable a Coverage Provider to absorb the lender's risk that insureds

8   may survive an anticipated fixed loan maturity period or any other specified period. The lender

9   would be the Coverage Recipient. A survival risk insurance policy would be issued by the

10   Coverage Provider which would allow the payoff of the loan including accrued loan interest at

11   the end of the fixed period set by the lender. Such a policy would be issued for the percentage of

12   death benefit of the life insurance policy sufficient to cover the loan plus accrued loan interest

13   requirement. The specified period for such a policy may be less than or equal to the maturity

14   period set by the lender.

15

16   As in the basic description of the present invention, the Coverage Provider will be entitled to

17   receive the death benefit proceeds or a percentage of the death benefit proceeds of each life

18   insurance policy covered by survival risk insurance in situations where the death of the insured

19   life occurs after the end of the specified period. The Coverage Provider would price the survival

20   risk insurance product on the assumption that it would receive, at least, a percentage of the death

21   proceeds equal to the amount paid by the Coverage Provider to the lender at the end of the

1 specified period plus interest at an acceptable rate from the end of the specified period until the

2 actual death of the insured life.

3

4 In addition, the Coverage Provider may undertake the responsibility to maintain the policy in-

5 force until maturity as described in variation 3.

6

7 The following provides numerical example of how the present invention would be applied to

8 calculate a premium for a survival risk insurance policy used in this sales or marketing concept.

9

10 This numerical example is based on an Age 65 Male Nonsmoker. The Coverage Provider

11 assumes mortality equal to 100% of the 1990-95 Basic Select and Ultimate Mortality Table.

12 Other variables are set as follows: T1=1.0, T2=1.0, F=1%, G=0%, E=0.5%, H=0.5%, i = 8%,

13 Y=100%, DB^m = $10,000,000. The specified period, which is equal to the loan maturity period

14 = 20 years. An annual loan = $895,390 is required to pay the policy premium for 6 years. The

15 loan interest rate = 6.00%. The interest is not paid in cash but accrues. Therefore, the

16 outstanding loan balance at the end of each year of the loan equals the original amount borrowed

17 plus accrued loan interest. The loan plus accrued interest will be repaid out of the death proceeds

18 when the insured dies. The amount of the annual premium, $895,390 payable over 6 years, is

19 calculated under reasonable assumptions to support the insurance policy with increasing death

20 benefit to recover loan balance plus $10,000,000.

21

Method of Calculating Premium Payment to Cover the Risk Attributable to Insureds Surviving a

Specified Period

1   Table 5 shows the calculation of the accrued loan balance and the death benefit required at the

2   end of each year to repay the loan plus accrued loan interest and provide a death benefit equal to

3   the original death benefit.

TABLE 5

Attained Age	t	Annual Loan	Annual Loan Interest	Cumulative Loan Balance	Original Death Benefit	Total Required Death Benefit
65	1	895,390	53,723	949,113	10,000,000	10,949,113
66	2	895,390	110,670	1,955,174	10,000,000	11,955,174
67	3	895,390	171,034	3,021,597	10,000,000	13,021,597
68	4	895,390	235,019	4,152,007	10,000,000	14,152,007
69	5	895,390	302,844	5,350,240	10,000,000	15,350,240
70	6	895,390	374,738	6,620,368	10,000,000	16,620,368
71	7		397,222	7,017,590	10,000,000	17,017,590
72	8		421,055	7,438,646	10,000,000	17,438,646
73	9		446,319	7,884,965	10,000,000	17,884,965
74	10		473,098	8,358,062	10,000,000	18,358,062
75	11		501,484	8,859,546	10,000,000	18,859,546
76	12		531,573	9,391,119	10,000,000	19,391,119
77	13		563,467	9,954,586	10,000,000	19,954,586
78	14		597,275	10,551,861	10,000,000	20,551,861
79	15		633,112	11,184,973	10,000,000	21,184,973
80	16		671,098	11,856,071	10,000,000	21,856,071
81	17		711,364	12,567,436	10,000,000	22,567,436
82	18		754,046	13,321,482	10,000,000	23,321,482
83	19		799,289	14,120,771	10,000,000	24,120,771
84	20		847,246	14,968,017	10,000,000	24,968,017
85	21		898,081	15,866,098	10,000,000	25,866,098
86	22		951,966	16,818,064	10,000,000	26,818,064
87	23		1,009,084	17,827,148	10,000,000	27,827,148
88	24		1,069,629	18,896,776	10,000,000	28,896,776
89	25		1,133,807	20,030,583	10,000,000	30,030,583
90	26		1,201,835	21,232,418	10,000,000	31,232,418
91	27		1,273,945	22,506,363	10,000,000	32,506,363
92	28		1,350,382	23,856,745	10,000,000	33,856,745
93	29		1,431,405	25,288,150	10,000,000	35,288,150
94	30		1,517,289	26,805,439	10,000,000	36,805,439
95	31		1,608,326	28,413,765	10,000,000	38,413,765
96	32		1,704,826	30,118,591	10,000,000	40,118,591
97	33		1,807,115	31,925,706	10,000,000	41,925,706
98	34		1,915,542	33,841,249	10,000,000	43,841,249

4

1   Therefore DB^m at the end of the 20th year is \$24,968,017.

2   Given the following values, $_{20}p_{65} = 0.48884$ and $v^{20} = 0.21455$, $PV1$ can be calculated as

3   follows: $PV1 = 0.48884 * 0.21455 * \$24,968,017 = \$2,618,661.15$.

4   Table 6 following provides additional information required to complete the calculation of the

5   survival risk premium for this example.

6

7   Since the death benefit for the life insurance policy, DB^m, varies year to year, the formula for

8   $PV2$ is modified for this example as follows:

9   $$PV2 = \{[\sum_{k=20}^{100-65-1} v^{k+1-20} \bullet_{k-20}p_{85} \bullet q_{65+k} \bullet T1 \bullet DB_k^m +_{15}p_{85} \bullet v^{15} \bullet T2] \bullet \frac{.08}{\ln(1.08)}\}$$

10 For this example, the life insurance policy which is part of this premium financing approach has

11 sufficient funding to only keep it in force through the end of policy year 33. Therefore, it will

12 lapse without value when the insured life is attained age 98. Thus, all values beyond attained age

13 98 are equal to zero and not a factor in this calculation.

TABLE 6

Attained Age	k	t	1990-95 Basic S&U Mortality Rates	q_{65+t} (= 100% of the 1990-95 Mortality Rate)	$_tp_{85}$	$_tp_{85}{}^*q_{65+k}$	v^{t+1} $_tp_{85}{}^*q_{65+k}$ $^*T1^*DB_k$	Summation of Previous Column
85	20	0	0.10287	0.10287	1.00000	0.10287	2,463,745.83	
86	21	1	0.11535	0.11535	0.89713	0.10348	2,379,320.19	
87	22	2	0.12771	0.12771	0.79365	0.10136	2,238,974.76	
88	23	3	0.13992	0.13992	0.69229	0.09687	2,057,415.09	
89	24	4	0.15184	0.15184	0.59542	0.09041	1,847,812.01	
90	25	5	0.16371	0.16371	0.50502	0.08268	1,627,206.52	
91	26	6	0.17782	0.17782	0.42234	0.07510	1,424,439.45	
92	27	7	0.19353	0.19353	0.34724	0.06720	1,229,225.77	
93	28	8	0.21345	0.21345	0.28004	0.05977	1,055,182.72	
94	29	9	0.23423	0.23423	0.22026	0.05159	879,548.35	
95	30	10	0.25253	0.25253	0.16867	0.04259	701,745.52	

TABLE 6

Attained Age	k	t	1990-95 Basic S&U Mortality Rates	q_{65+t} (= 100% of the 1990-95 Mortality Rate)	$_tp_{85}$	$_tp_{85}*q_{65+k}$	v^{t+1} $_tp_{85}*q_{65+k}*T1*DB_k$	Summation of Previous Column
96	31	11	0.26709	0.26709	0.12608	0.03367	536,479.47	
97	32	12	0.27242	0.27242	0.09240	0.02517	388,057.49	
98	33	13	0.28031	0.28031	0.06723	0.01885	281,290.59	19,110,443.77

1

2 Given $.08/(\ln(1.08)) = 1.03949$, then

3 **PV2** = $19,110,443.77 * 1.039487 = \$19,865\ 057.86$ and

4 **PV3** = $0.48884 * 0.21455 * \$19,865,057.86 = \$2,083,459.62$.

5 For purposes of calculating the terms involving the factors E and F the death benefit at the end of

6 policy year 20 which is $24,968,017 is used. For purposes of calculating the terms involving the

7 factors G and H the death benefit at the end of policy year 33 which is $43,841,249 is used.

8 This makes **SPR**^{m} = ($2,618,661.15 - $2,083,459.62) + $438,412.49 + $249,680.17 =

9 $1,223,294.19

10

11 **Application 2: Investment Returns Based on Death Benefits**

12

13 A life insurance policy can be priced or funded to provide life insurance for a specified term, L.

14 A group of such policies can be purchased by a purchasing entity on the lives of persons on

15 whom such purchasing entity can establish an insurable interest. An entity has insurable interest

16 in a life if that entity has a financially interest in said life not dying. Premiums payable to the life

Method of Calculating Premium Payment to Cover the Risk Attributable to Insureds Surviving a

Specified Period

1   insurance company issuing the policies can be calculated to support the policies for the L year

2   term.

3

4   In this situation the purchasing entity purchased the life insurance policies with a reasonable

5   expectation that death benefit proceeds would be received during the period L according to a

6   scheduled based on a mortality assumption. After a certain number of years, P, the purchasing

7   entity (generally a corporation or trust) may determine that it would like to protect itself from the

8   risk of death benefit proceeds being received that were less than what it originally assumed. By

9   eliminating this risk the purchasing entity would be guaranteed an investment return provided by

10   the death benefit proceeds on the life insurance policies it purchased and funded.

11

12   In order to provide itself with this protection the purchasing entity can purchase survival risk

13   insurance from a Coverage Provider on each life on which it owns life insurance. The

14   purchasing entity would be the Coverage Recipient. The specified period for such a survival risk

15   insurance policy would be set equal to L - P. In order to achieve the desired level of protection,

16   or survival risk transfer, the purchasing entity may only purchase a survival risk insurance policy

17   covering a percentage Y (less than 100%) of each original life insurance policy's death benefit.

18

19   Such percentage Y will be determined such that the Coverage Provider can attain its desired

20   profit while the purchasing entity or Coverage Recipient can ensure that its expected return will

21   be guaranteed not to fall below a predetermined rate. The predetermined rate would be affected

22   by the terms of survival risk insurance policy.

Method of Calculating Premium Payment to Cover the Risk Attributable to Insureds Surviving a Specified Period

1

2   In this application the Coverage Provider will continue the premium paying obligation to the life

3   insurance company that issued the life insurance policy on the insured life until the Coverage

4   Provider received sufficient death proceeds to satisfy its pricing requirements.

5

6   The following provides a numerical example of how the present invention would be applied to

7   calculate a premium for a survival risk insurance policy used in this application.

8

9   This numerical example is based on an Age 70 Male Nonsmoker. The Coverage Recipient

10   purchased 1,000 identical policies for a single premium of $546,938,000 paid to an insurance

11   company which issued the life insurance policies. Said single premium was determined to be

12   sufficient to keep the policies in force for 15 years under the Coverage Recipient's assumptions.

13   The Coverage Recipient assumed mortality equal to 125% of the 1990-95 Basic Select and

14   Ultimate Mortality Table for the 1,000 identical risks. The Coverage Provider assumed mortality

15   equal to 100% of the 1990-95 Basic Select and Ultimate Mortality Table. Other variables are set

16   as follows by the Coverage Provider: $T1=1.0$, $T2=1.0$, $F=2\%$, $G=0\%$, $E=2\%$, $H=2\%$, $i = 6\%$,

17    $Y=100\%$. The DB^m for each policy equals $3,000,000.

18

19   The effective year of the contract between Coverage Provider and the Coverage Recipient is 3

20   (that is, after 2 policy years) and the specified period is equal to 13 which is 15 - 2. There is an

21   additional annual life insurance premium required per the original life insurance policy to be paid

22   by the Coverage Provider from policy year 16 of the life insurance policies and thereafter. The

23   additional annual premium is $320,000. This premium is required to keep each of the life

1   insurance policies in force after policy year 16 so that the Coverage Provider will be able to

2   receive the death benefit proceeds when the insured lives die. The total life insurance premium

3   in year 16 and thereafter is calculated as the product of $320,000 and the number of survivors

4   expected in each year thereafter. This is shown in Table 7.

5

TABLE 7

Year	Attained Age	Premium	Cash Value	Death Benefit Proceeds	Expected # of Survivors	IRR-1	IRR-2
0		546,938,000	0	0	1000		
1	70		549,168,282	22,275,000	991		
2	71		560,443,486	34,876,604	976		
3	72		563,972,423	47,269,502	957		
4	73		559,557,017	58,925,030	932		
5	74		547,583,509	68,008,776	904		
6	75		528,000,273	76,726,077	873		
7	76		500,418,632	86,511,547	838		
8	77		464,957,553	95,878,995	799		
9	78		422,492,633	101,322,212	759		
10	79		372,884,420	106,623,332	717		
11	80		315,201,008	115,309,304	672		
12	81		246,319,765	138,719,061	619		
13	82		168,778,185	156,433,168	560		
14	83		84,458,069	186,890,071	491		
15	84		64,788	194,218,462	421	11.41%	8.88%
16	85	134,720,000	46,514,758	192,790,892	354		
17	86	113,280,000	74,218,115	188,971,956	290		
18	87	92,800,000	86,273,649	179,208,411	233		
19	88	74,560,000	86,396,754	165,323,046	182		
20	89	58,240,000	78,494,058	148,152,196	139		
21	90	44,480,000	66,337,413	129,671,426	103		
22	91	32,960,000	52,912,484	112,220,143	75		
23	92	24,000,000	39,793,682	95,136,433	52		
24	93	16,640,000	27,939,075	79,575,398	35		
25	94	11,200,000	18,179,087	64,109,616	22		
26	95	7,040,000	10,929,361	48,881,392	13		
27	96	4,160,000	6,015,739	35,380,059	0		
28	97	0	2,970,387	24,038,303	0		
29	98	0	1,101,914	16,311,794	0		

TABLE 7

Year	Attained Age	Premium	Cash Value	Death Benefit Proceeds	Expected # of Survivors	IRR-1	IRR-2
30	99	0	124,670	10,950,174	0		

1

2 Using the methods of the present invention in a computer implemented calculation, a value for

3 **SPR** = $140,868,855 is determined. This is the payment made by the Coverage Recipient to the

4 Coverage Provider at the beginning of policy year 3 (that is, the end of policy year 2) to purchase

5 survival risk insurance for the life insurance policies purchased by the Coverage Recipient. This

6 survival risk insurance would be structured so that the Coverage Provider guarantees that death

7 benefit proceeds from the life insurance policies purchased will at least equal the expected death

8 benefit proceeds per the Coverage Recipient's assumptions during the 15 year specified period.

9 As shown in the table, the Coverage Recipient's expected return prior to purchasing survival risk

10 insurance was 11.41% (column IRR-1). With survival risk insurance the Coverage Recipient can

11 guarantee a return of 8.88% (column IRR-2).

12

13 **Application 3: Specified Threshold of Probability of Death.**

14

15 A specified period, N, will be a number of years set on the basis of a threshold probability of the

16 insured's death occurring during such N year period. For example, N may be set such that the

17 probability of the death of the insured within the specified period is 0.75. This means that under

18 the mortality assumption used to calculate the probability there is a 75% probability that the

1   insured will die before the end of the specified period. This also means that there is a 25%

2   probability that the insured will survive to the end of the specified period.

3

4   For each life insurance policy within a group of life insurance polices, a specified period N will

5   be determined such that the probability of the death of the insured life during that specified

6   period is equal to or nearly equal to the threshold probability of death. From such group of life

7   insurance policies, those life insurance policies with the same specified period, N, will be

8   selected. There can be 2 or more selected groups each having the desired threshold probability

9   of death relative to different specified periods, N. Mortality assumptions deemed appropriate for

10   the lives being analyzed by the entity creating such selected groups (selecting entity) will be

11   used.

12

13   To eliminate, reduce, or manage the survival risk associated with any such selected group, the

14   selecting entity may purchase survival risk insurance from a Coverage Provider. The selecting

15   entity is the Coverage Recipient.

16

17   The survival risk insurance policy purchased by the Coverage Recipient will pay amounts equal

18   to the death benefits of the survivors of the specified period, N, with respect to a selected group

19   per the present invention. The Coverage Provider will charge a premium to the Coverage

20   Recipient for the survival risk insurance.

21

Method of Calculating Premium Payment to Cover the Risk Attributable to Insureds Surviving a

Specified Period

1   The Coverage Provider will make its own mortality and other assumptions in calculating the

2   survival risk insurance premium. In particular, the mortality rate assumptions used by the

3   Coverage provider may not be the same as the same mortality rate assumptions used by the

4   Coverage Recipient or any other entity.

5

6   The following provides a numerical example of how the present invention would be applied to

7   calculate a premium for a survival risk insurance policy used in this sales or marketing concept.

8

9   For a male, age 70, nonsmoker, a Coverage Provider assumes mortality rates equal to 900% of

10   1990-95 Basic Select and Ultimate Mortality Table. Values for the other factors required for the

11   present invention are: $T1=1.0$, $T2=1.0$, $F=1\%$, $G=2\%$, $E=1\%$, $H=2\%$, $i = 8\%$, $Y=100\%$, and DB^m

12   = \$1,000,000. The Coverage Provider decides to use a threshold probability of 0.9999.

13   Therefore, the specified period N will equal the period N for which the probability the insured

14   will die during the period is .9999. The insured's probability of survival during the period is

15   .0001.

16

17   For the assumptions used in this example, the specified period N would equal 16 years.

18   Using a computer implementation of the present invention as demonstrated in the preceding, a

19   value for $\mathbf{SPR}^m = \$60,022$ can be calculated.

20

21   **Definitions**

22

Method of Calculating Premium Payment to Cover the Risk Attributable to Insureds Surviving a

Specified Period

1   The following definitions of terms used herein will be helpful in understanding the present

2   invention.

3

4   "Survival risk" is the financial risk that a third party beneficiary faces from a set of insured lives

5   living longer than expected. While not being held to this explanation, survival risk exists, in

6   part, because the mortality assumptions used to evaluate survival in a group of lives to the end of

7   a specified period are dependent upon the *Law of Large Numbers*. The *Law of Large Numbers*

8   states that the mean of a random sample drawn from a large population will approach the mean

9   of the population as the sample size n increases. If a group's size is not large enough, then the

10   survival risk calculated for the group will be subject to "statistical fluctuation" for small values

11   of n.

12

13   The *Weak Law of Large Numbers* states that there exists an integer n̲ such that a sample of size n̲

14   or larger will have a <u>sample mean</u> which deviates from the <u>population mean</u> by $< \varepsilon$ with a

15   probability $\geq (1 - *)$. Typically, this sample error is expressed in the form of a 95% probability

16   or confidence (when $* = .05$) that the sample mean will differ from the population mean by $\pm \varepsilon$.

17

18   In addition, the survival risk exists, in part, because the assumptions initially made in calculating

19   it may have been wrong or the mortality experience of the group may change after the

20   calculation was made.

21

Method of Calculating Premium Payment to Cover the Risk Attributable to Insureds Surviving a Specified Period

1   The "beginning date" is the issue date of a survival risk insurance policy. It is the date on which

2   the risk transfer of the survival risk is made. The beginning date is the start of a specified period.

3

4   The "end date" is the end of the specified period of time. For example, 20 years after the

5   beginning date.

6

7   A "selected group" is a group of lives selected based on a mortality rating.

8

9   A "positive difference between the expected death benefit and an actual death benefit" references

10 the death benefits paid by the original life insurance company which issued the life insurance

11 policy on an insured life. Typically, the difference between the death benefits expected to be paid

12 by the original insurer to the Coverage Recipient and those actually paid by the original insurer

13 to the Coverage Recipient during the specified period will be a positive number or zero.

14

15 However, it is also possible that the expected death benefit will be less than the actual death

16 benefit and the difference will be negative. In one embodiment, only positive differences will be

17 paid by a Coverage Provider to a Coverage Recipient under the terms of a survival risk insurance

18 policy. A negative difference does not imply an explicit payment by the Coverage Recipient to

19 the Coverage Provider. Any potential negative difference would be reflected in the premium the

20 Coverage Provider charges for the survival risk insurance policy.

21

1   "Transferring ownership" means the Coverage Recipient assigning the original life insurance

2   policies to the Coverage Provider or in some other way assuring that the death benefits of these

3   policies will be paid to the Coverage Provider after the end of the specified period.

4

5   The "designated beneficiary" is the entity entitled to receive the death benefit proceeds of a life

6   insurance policy. The designated beneficiary is usually designated by the life insurance policy

7   owner.

8

9   "Premium" refers to the premium the Coverage Provider would charge for the survival risk

10   insurance policy it issues, unless otherwise indicated.

11

12   An "in force death benefit" of a life insurance policy is the amount, as of a specific date, that

13   would be payable if the life insured under such life insurance policy died on that specified date.

14   With respect to the present invention the specified date is, typically, the end of the specified

15   period.